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Financing Green Hydrogen Projects

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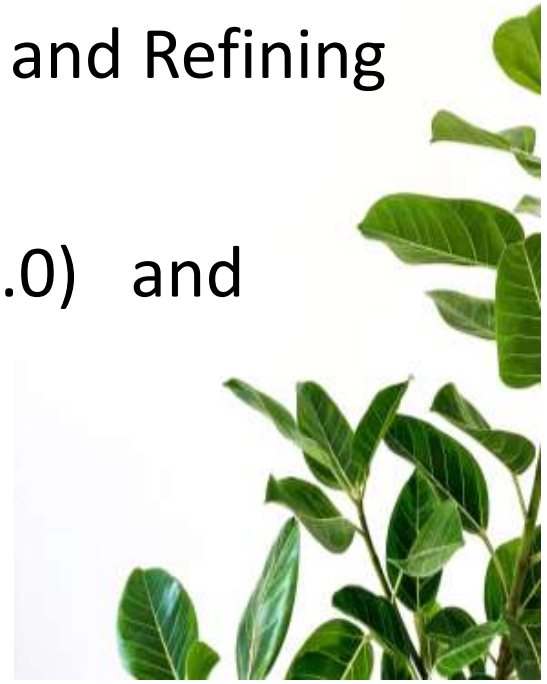
Demand of Green H2 in India

- India’s Hydrogen demand
- Presently at 6.1 MMT mainly for Ammonia (3.0 MMT) and Refining (2.2 MMT)
- By 2030 = 25 MMT mainly for STEEL (8.0) Ammonia (9.0) and refining (4.0)
- Green H2 Capacity addition by 2030 – 8 MMT



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Application of H2 in India – Now and expected in 2030

- Current Application - Fertilisers, Chemicals and Refineries
- Potential Application –
- Transport - H2 Hydrogen Fuel Cells Buses, Heavy commercial flights, Shipping Aviation
- Power – Long term Energy storage, off grid power system
- Industry – Steel, Cement, Fertilizers, Refineries

Production Cost – Present and in 2030

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- **Current production cost** – 2.5 – 4.0 USD/ kg
- Transmission, storage, and handling cost 1.5 USD/ kg
- Landed cost = 4.0-5.50 USD / Kg (large scale Green H2 application possible at 3.0-3.5 USD/Kg where generation units are co located).
- **2030 expected cost** - $1/ Kg (1:1:1 Mukesh Ambani announced target of 1:1:1 means One $1 for One kg in One Decade)
- **This would be possible only with substantial reduction –**
- **in the cost of Electrolysers and Renewable energy with increase in the volumes and**
- **technological changes.**

Green H2 cost comparison with Conventional fuels USD / kg

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- Natural Gas 0.92 – 3.20
- Coal 1.20 -2.20
- Natural Gas with CCU 1.50 – 2.90
- Green H2 3.0- 7.50

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WHY SHOULD INDIA INVEST IN GREEN HYDROGEN

- **Energy and Food Security** – Self-reliance in H2 production can significantly reduce India's energy and ammonia imports
- **Decarbonisation** -Green H2 can catalyse over 20% reduction in Emissions primarily through Industrial Decarbonisation
- **Significant Export Potential** -Driven by the abundant availability of renewable energy at one of the lowest costs globally, India can potentially capture a large share globally in the Green H2 market

SIGNIFICANT CAPEX REQUIREMENT BY 2030

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- Expected investment requirement by 2030 – **160 billion USD**
- 70% of it required to generate adequate renewable energy to power the electrolysers
- Rest will be required to set up to set up the electrolyser assembly / green hydrogen production units

SOLAR POWER 2021 VS GREEN HYDROGEN IN 2031

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PARTICULARS	SOLAR POWER INDUSTRY (2021)		GREEN HYDROGEN (2031 F)	
	BULL CASE		BEAR CASE	
• 10-year capex (USD bn)	36.40		160	
160				
• Est. Revenue (USD bn)	3.03		21.00	
27.00				
• Est. EBITDA (USD bn)	2.72	9.45		12.15
• 10 yr CAPEX/Revenue (x)	12.02		7.63	
5.93				
• 10 yr CAPEX/EBITDA (x)	**13.36**		**16.94**	
13.18				

Why should you Invest in Green Hydrogen?

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- Early Mover Advantage is going to be crucial
- High Initial Returns similar to Solar Industry in last Decade
- Strong support from governments looking to increase the uptake
- Increasing importance of ESG
- Ability to secure Long Term Offtake Agreements
- Exponential Growth in Addressable Market
- Mandates for use of Green Ammonia

Is Green hydrogen the holy grail!! Green Hydrogen is the nearest to replace Natural gas and therefore with unlimited potential

Means of Investments

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a. **Equity-** financed by sources such as energy focused private equity funds, climate investment fund, corporates, etc.

b. **Debt-** financed by sources such as public sector lenders, international banks, development financing institutions, multilaterals, etc.

- **Sovereign Green Bonds** – Govt has already announced
- **Foreign Direct Investment (FDI**)

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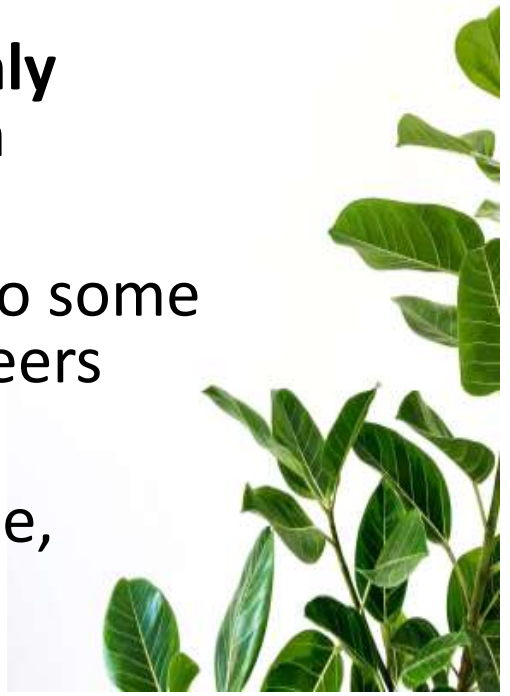
There is increasing scrutiny of ESG metrics for renewable energy projects

- Foreign banks and overseas investors have mandates and so they use **ESG as a negative screening** in their investment decision making.
- IPPs are preparing for the future where **importance of ESG will only increase** due to higher scrutiny by all lenders, investors and Indian regulators.
- IPPs are **competing strongly to raise capital** for portfolio growth so some see better ESG scores as a way to differentiate themselves from peers
- IPPs recognize that proper action on ESG criteria, such as water use, **reduces the risks to their own business** operations



Challenges

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- Policy coherence
- Wheel power or transport H2?
- H2 or EV for heavy duty transport?
- Infrastructure readiness
- Gas pipelines may be adaptable to H2
- Grid reliability and open access remain challenges
- End user readiness will take time
- Competition from CCUS and bioenergy options
- Availability of finance will dictate pace
- Scale of RE deployment required is unprecedented
- Just transition –fossil fuels support a lot of jobs
- Repurposing and reskilling an imperative

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Public sector Support imperative for Investment in Green H2 and Private sector capacity building –

- Supporting Electrolyser R & D and production – including PLI Scheme
- De risking Investment in large scale Green H2 projects – with suitable risk sharing framework on a PPP basis
- Subsidising Green production directly and indirectly
- Linking Renewable projects with Green H2 production
- Establishing production hubs and developing infrastructure for Green H2
- International partnership for technology and finance cooperation for promoting Green H2

Conclusion

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- No alternate to Green Hydrogen to save the planet – so huge huge potential
- Financing Hydrogen is a very big challenge mainly in view of –
  - Very high incomparable cost of production
  - Technological is still at immature stage – risk of obsolescence
  - Safety Risk – risky molecule to handle while storage and transportation
- Estimated Capex of 160 Billion $ required by 2030 – international cooperation a must both for Equity and Debt financing.
- Mission 1:1:1 – an imperative
- ESG integration with the entire value chain – A must
- Public sector participation for developing infra structure , PLI / other grants etc needed to encourage Private sector

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Thank you